The Tasmanian Thylacine Sighting Record Database (TTSRD): 1,223 quality-rated and geo-located Thylacine observations from 1910 to 2019

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ABSTRACT

The Thylacine or 'Tasmanian tiger' (*Thylacinus cynocephalus*), an iconic canid-like marsupial predator and last member of its taxonomic family (Thylacinidae) to have survived to modern times, was declared officially extinct in the early 1980s, half a century after the death of the last captive animal. However, the regularity and frequency of sightings of the species over more than eight decades since has not only created a zoological mystery, but also made it challenging to reconstruct the timeline of the fate of the species. To help resolve this intriguing historical-ecological problem, we compiled and curated a comprehensive inventory of documented sighting records from Tasmania from 1910 to 2019. By examining sources spanning official archives, published reports, museum collections, newspaper articles, microfilm, contemporary correspondence, private collections and other miscellaneous citations and testimony, we have amassed 1,223 unique Thylacine records from this period and resolved previous anomalies and duplications. Each observation in the database is dated, geo-tagged, categorised, quality-rated, referenced and linked to an image of its source material. Although purported observations have occurred every year, reporting rates vary across the decades in terms of frequency, type, location, and quality rating. Here we describe the database in detail, highlight its value for research, interpret the major patterns revealed by this archival compilation, and discuss the broader implications of the result of this work on the likely time and place of the Thylacine's extinction in the wild.

Key Words: *Thylacinus cynocephalus*, Tasmanian tiger, historical records, archive, sightings, uncertainty, extinction.

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Introduction

The Thylacine or 'Tasmanian tiger' (*Thylacinus cynocephalus*) is the largest marsupial carnivore to have survived into modern times (as illustrated in Fig. 1). The last captive specimen died at the Hobart Zoo in the Queen's Domain on the night of the 7th September 1936[1]. This is widely accepted as the extinction date for the species, and now marks the annual National Threatened Species Day (formerly *National Thylacine Day*) in Australia. The authoritative consensus on the present-day status of the Thylacine is that it is extinct. The species is listed as such under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), and under the International Union for Conservation of Nature (IUCN) Red List 2012 (McKnight 2008). In March 2013, the Thylacine was delisted from CITES Appendix I (species threatened with extinction) in accordance with Resolution Conf. 9.24 (Rev. CoP15). Yet apparently credible sightings are persistently reported, through to the first decades of the current century, and recent formal statistical modelling suggests the likely persistence of the species for many decades after the final captive animal died (Brook *et al.* 2023). How then can the formal status of the species be reconciled with these observations?

1 Hobart City Council Reserves Committee, dated 16/9/1936, point 10.

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Figure 1. Artists' impressions of two events in the decline of the Thylacine. Top: the famous sighting by NPWS officer Hans Naarding in 1982 [painted by, and reproduced with permission from, Bill Flowers]. Bottom: *'the last Thylacine'*, which likely died unobserved, somewhere in the remote southwest region of Tasmania [painted by, and reproduced with permission from, Graeme Brook].

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Extinct or Extant? Ambivalent scientific opinion

Bailey (2019) states: "*The age of certainty ended with the death of the world's last known captive Thylacine, and almost at once, the era of improbability commenced*". The survival of the Thylacine beyond the death of the last captive specimen is both emotive and perplexing, with opinion divided between those who believe the species is now extinct and those who are convinced of its continued survival in the remote wilderness of the island of Tasmania. Even scientific authorities appear to hedge their bets, with use of the terms "probably" or "possibly" extinct. The Tasmanian Parks & Wildlife Service (PWS)[2] states: "*The Thylacine is the only mammal to have* ***(possibly)*** *become extinct in Tasmania since European settlement*". They continue: "*Nonetheless, the incidence of sightings introduces a reluctance among some authorities to make emphatic statements on the status of the species. Even if there did exist a few remaining individuals, it is unlikely that such a tiny population would be able to maintain a sufficient genetic diversity to allow for the viable perpetuation of the species in the long-term*". The Australian Museum website[3] also uses the somewhat guarded term "*now believed to be extinct*", rather than extinct. As recently as 2012, the European Commission's legislation[4] on the protection of species and wild fauna lists the Thylacine as "possibly" extinct. The National Museum of Australia (2019) states: "*Thylacines are functionally extinct which means that any remaining population is so small that the species no longer plays a significant role in the ecosystem*". The absence of scientific consensus naturally adds uncertainty to the debate over extinction versus survival.

The extinction of a species occurs when the last individual member of that species dies, although the capacity to recover likely diminished long before this point is reached due to genetic deterioration or a breakdown in social cohesion (Brook and Alroy 2017). Even in the early days of colonial settlement, the Thylacine was elusive and rarely seen (Evans 1822; Jeffreys 1820). Persecution by graziers (encouraged by government and private bounties[5]), incidental snaring by fur trappers (Haygarth 2017), habitat modification, and possibly a disease epidemic (Paddle 2012), all contributed to a late 19th and early 20th century population decline, such that Thylacines were regarded as extremely rare by 1910, with the final confirmed kills and captures occurring in the early 1930s (Sleightholme *et al.* 2020).

Prior to 1994, the International Union for the Conservation of Nature (IUCN) deemed a species to be extinct if it had not been seen or recorded in the past 50 years. However, Collar (1998) cautions: "*Over the past few decades there have been enough rediscoveries to warn us against overhasty assumptions of extinction (which may, I suspect, sometimes derive from simplification of the Committee for the International Trade in Endangered Species (CITES) criterion of 50 years without a record)*". Sleightholme & Campbell (2016) agree: "*…logic dictates that a secretive nocturnal animal, concealed amongst vast tracts of extremely dense vegetation, would persist well beyond the last known capture on the fringe of its habitat*" and conclude that "*…the Thylacine survived with near certainty beyond the death of the last captive specimen in 1936, and that the species was extant throughout the 1940s, and possibly beyond*". Baumsteiger & Moyle (2017) concur on the general principle: "*Determination of extinction can be surprisingly complicated. It is often difficult to say with certainty when the last individual is gone because most lineages are cryptic at small population sizes, making it difficult to determine no reasonable doubt*". The IUCN's 50-year precept has now changed, with the focus shifting from time lapse to exhaustive survey: "*A taxon is extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed extinct when exhaustive surveys in known and / or expected habitat, at appropriate times (diurnal, seasonal, annual), and throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form*" (IUCN 2001), but this does not apparently alter Red List classifications enacted before the change in emphasis.

The absence of any road-killed specimen is often cited as firm evidence for extinction (see reviews in Lang 2014). However, in Tasmania the larger marsupial carnivores collectively accounted for only 2.8% of total road kills in a 1979 survey (Smith 1981) and 1.2% in a large inventory collected during 2001–2004 (Hobday and Minstrell 2008). Moreover, animal corpses are rapidly cleared by scavengers, principally Tasmanian Devils (*Sarcophilus harrisii*). A more recent survey by the Tasmanian Conservation Trust (2017), confirms this to still be the case. Smith concludes: "*If a small, dispersed population of Thylacines still exists, the probability of one being killed on the road is very small*". Consequently, the 'missing roadkill' argument should not be viewed as conclusive evidence for the extinction of elusive species like the Thylacine.

Finally, the notion of an "*exhaustive survey*" as stipulated by the IUCN, has arguably never been

2 https://www.parks.tas.gov.au/?base=4765 (accessed 30/3/2019)

3 https://australianmuseum.net.au/learn/australia-over-time/extinct-animals/the-Thylacine/ (accessed 30/3/2019).

4 Commission Regulation (EU) No 1158/2012 of 27/11/2012 amending Council Regulation (EC) No 338/97 on the protection of species of wild fauna and flora by regulating trade therein.

5 The government bounty ran from 1888 until its termination in 1908, although payments continued to be made into 1909. The Van Diemen's Land Company's (VDLC) two bounty schemes ran from 1830 until their termination in 1914, with a two-year hiatus from 1838-1840. A number of local bounties ran in concert with the government bounty.

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fully realised for the Thylacine. Although numerous surveys[6] have been undertaken, all have been of short duration and limited in scope. Guiler (1985) acknowledged this to be the case: "*It is disappointing that no world fauna body has sponsored a thorough search for them, the rarest of the world's mammals*". Despite advancements in motion/heat-triggered camera traps, vast remote areas remain poorly surveyed, and there was almost no coverage prior to the 21st century (Brook *et al.* 2018). However, it is worth noting that the probable prime habitat of the Thylacine (the dry forests and grasslands of the eastern and northern regions of the state) have now been repeatedly surveyed with camera traps by PWS, researchers and the general public. As such, the chances of any residual animals remaining undetected in these areas are now very low, and further diminishing as each year passes.

Sightings

L. D. Crawford (1953) of the Queen Victoria Museum (Launceston) wrote that "*There is enough direct evidence to suggest that it* [Thylacine] *is not yet extinct*". One could justifiably question, when did the quality of sighting evidence, deemed sufficient to suggest species persistence as of 1953, cease to meet the standards for such inference? Guiler (1985) later stated that: "*It never ceases to surprise me that since 1936 it has been lamely accepted that the Thylacine was extinct or nearly so, even in the face of persistent sighting reports, some of which will stand considerable critical examination*". Sleightholme & Campbell (2016) later expanded on this sentiment: "*The credibility of post-1936 Thylacine sighting reports is invariably questioned, and often disparaged. Why this should be so is not entirely clear, as the validity of sightings for other critically endangered species are rarely dismissed so readily, particularly when those observations are reported within a few years of the species last being known to exist. A substantial number of reported sightings in the 1940s and early 1950s were made by multiple persons sighting the same animal, or by bushmen or farmers with first-hand knowledge of the Thylacine, yet these reports appear to carry little or no credence with the scientific community, and one must surely question why. We are of the opinion that the sighting data, largely compiled from the species' interactions with non-scientists (i.e., bushmen, hunters, farmers, amateur naturalists and members of the public), constitutes an important and underutilised source of information about the Thylacine's prevalence and former distribution*".

Paddle (2014) acknowledges the importance of sightings reports: "*Records of Thylacines post-1936 are undoubtedly of interest to the scientist as well as the lay researcher*". Yet, he qualifies his statement by adding: "*While they do not amount to evidence for the continued existence of the species—nothing but a body will change that designation—nevertheless, should that evidence be forthcoming, then the information obtained from recent sightings will be seen to possess valuable distributional and behavioural data of relevance to the continued welfare of the species*". Although the discovery of a live specimen or a carcass would serve as indisputable confirmation of the species' continued existence, it may be overly restrictive to discount potentially credible sightings as evidence unless such definitive criteria are met. Indeed, Roberts et al. (2010) state: *Assessing the validity of alleged sightings is particularly important for species that are critically endangered or thought to be extinct. What is accepted as a valid sighting can have a substantial effect on any assessment of whether extinction has happened, with concomitant implications for the assessment of subsequent sightings*". Quoting (wildlife researcher) David Pemberton, Owen (2003) states: "*…he doesn't rule out the possibility of as few as 50 having a viable existence… The problem is to prove that existence. Instead, he looks to a statistical analysis, to get as close as is possible to a 'proof' of sorts that it may be out there; specifically, 'the area that most biologists would agree on, the north-west: the Arthur River, Tarkine, across to Rocky Cape-that big block in there. Or stretch it a bit further east to Cradle Mountain, Lake Lea, St Valentine's Peak'. That's a large area. A population of fifty to a hundred wouldn't be easy to find. Add to this the animal's nocturnal habits and retiring nature and the odds of one being out there are quite high because they were in that area in the fifties; they were there*".

Beyond physical evidence (kills and captures, with a body or live animal produced), sightings can be sub-divided into two main groups: 1) visual encounters and 2) secondary evidence in the form of tracks, kills, and vocalisations. They can also be immediate (reported within hours, days, or weeks) or retrospective (reported within months or years after the event). Secondary evidence is the most uncertain. Animal tracks, unless made in perfect substrate, can easily be misinterpreted, and even for experienced eyes, tracks of the Common Wombat (*Vombatus ursinus*) or Tasmanian Devil are often confused with those of the Thylacine (Guiler and Godard 1998). Tracks can also be easily faked, and some that have received media attention most likely were. The remains of Thylacine predation are unlike those of dogs (Guiler 1985), but only an experienced pre-1940s bushman or wildlife expert with an in-depth knowledge of the species would be able to state with any confidence that a kill was made by a Thylacine. There were no historical audio recordings made of Thylacine vocalisations and few people living remember them, so any report of calls is questionable and prone to misidentification.

6 Summers, Higgs & Murthick (April, 1937); Fleming (Nov, 1937); Fleming, Boyd, Royle & Sharland (Nov, 1938); Fleay (1945-46); Guiler (1959, 1960, 1961, 1963, 1980-81); Griffith, Malley & Brown (1968-1972 *non-continuous*) (Griffith 1972b); Smith & Pyrke (1980 *non-continuous*); Mooney (1982-1983) and Wright (1984),

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Comments on the reliability of reports

There are no obvious qualitative difference between sightings made before and after 1936, when the last captive individual died. That is, in terms of the characteristics (behaviour observed, location/habitat, type of ancillary information, etc.) and overall apparent plausibility of the sightings reported, there is no obvious dividing point in time. These issues were explored in detail in the Supplementary material of Brook *et al.* (2023) and we would encourage careful scrutiny of this material, and in combination with the probabilistic modelling presented here, to form an impartial opinion. In brief, it may not be entirely appropriate, *prima facie*, to simply assume that all post-1936 sightings can be summarily dismissed, given that many of the accounts (rated credible by authorities) hold up to careful scrutiny. It is arguably more appropriate, for all records post-dating the last Thylacine kill or capture, to be considered possible, but uncertain. Logic says that the more time that has passed since the last confirmed record, the less likelihood *any* record has of being correct. This leads to a pressing conundrum: how should one handle the multitude of uncertain sightings? Is it more prudent to discard them for lack of verifiability, or can they be used probabilistically to yield a more nuanced estimate of the most probable extinction date?

The majority of sightings recorded between 1910 and 1936 were probably genuine, as there would be little to be gained by an individual reporting a sighting when the species was known to still exist (although the ubiquitous misidentifications no doubt also occurred during this period). After 1936, no such presumption can be made. The fact that the date of the last known Thylacine is precise (a captive animal) has created a psychologically critical point in time. Perhaps if there was less certainty about the last known animal, there would be less scepticism about the validity of sightings around this time.

Tammy Gordon, former Collection Officer at Queen Victoria Museum and Art Gallery, Launceston (pers. comm., 2023) states:

> "*First-hand witness testimony is notoriously unreliable, but once the sighting is recorded by another person it becomes second hand testimony and even less reliable. It is subject to potential bias by the person receiving the report. Information can be lost or even added, not deliberately, but simply by the nature of the process*".

Gordon expands upon this from her own personal experience:

> "*Confirmation bias has affected the way QVM records might be interpreted. For example, Bob Green [former QVM Curator] had a bias toward believing thylacines still existed which attracted a lot of sighting reports which then only reinforced Bob's personal belief/bias. His successor had a firm bias toward thylacines being extinct and actively discouraged sighting reports. When this became known people quickly learned not to report sightings to the Museum. A drop off in sightings confirmed the new curator's belief that they were extinct. So, the Museum's lack of sightings in the 1990s reflects a reluctance to report rather than a decline in thylacine sightings. In my experience people would actively seek out the person who was going to believe them*".

Such critiques are valid. However, most post-1936 reports described herein were sourced from PWS files, undertaken using a set questionnaire with no non-observer input, thus mitigating the bias concerns. The observer simply had to complete a series of set questions to report their sighting. The reports were then critically assessed by experienced PWS staff to see if they warranted further investigation.

Previous sighting compilations and associated analysis

There have been past efforts at collating sighting compilations: Griffith, Malley & Brown (1969 – 1972), the Embergs (1970s), Bailey (1968 – 2021), Terry (2005), and Holmes (2019),. However, most were undertaken for personal research, limited in scope, and not formally published or undertaken using a rigorous and systematic method. The most comprehensive and well-documented sighting studies of the Thylacine are those of Smith (1981) and Nix (1986), the latter published as Anon. (1990) as a map with no detail on individual records.

Steven Smith, a PWS officer, was formally tasked with investigating and rating the body of available sightings from 1936 to 1980, resulting in 320 observations sourced largely from the records of the Tasmanian National Parks & Wildlife Service (NPWS, now PWS) and the Queen Victoria and Tasmanian Museum archives. He noted that a large number of additional sightings remained undocumented or only anecdotally reported, suggesting that the reason for these unrecorded reports might relate to a fear of public ridicule, or concerns over changes in land use or reservation status should Thylacines still be found to inhabit a specific area. Smith graded[7] each of the sightings as either good (107), fair (101) or poor (112), with the criteria used to rate the reports being:

7 Smith's scale is still used to this day as a reliable guide with which to rate sightings.

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1. The description of the animal,

2. The observer's credibility and their experience with native fauna,

3. The circumstances of the sighting (e.g., visibility, period of observation, etc.),

4. Correlation with other sighting reports and previous Thylacine distribution (from bounty payments and the early Tasmanian literature).

Smith noted a marked increase in reported sightings after 1950, with 77% of the reports occurring between 1960–1980. This is in part elicited by the well-publicised Griffith, Malley & Brown search: Griffith (1972b), providing some support for the hypothesis that increases in reported sightings can correlate with the timing and intensity of media coverage (e.g., foxes: Marks *et al.* 2017). Sightings for the period 1936-1980 were reported by a variety of different observers with 'locals' accounting for 72.5%, shooters 9.3%, bushwalkers 5.8%, government officers (including police) 5%, tourists 3.5%, anglers 3.1% and four-wheel drive motorists 1%. Most sightings were concentrated in the northern half of the state between latitude 41° S and 41.2° S, with the longitudinal distribution being more dispersed. Between 1970–1980, the majority of sightings were reported from the eastern half of the state, but for the period 1936–1980, the distribution of 'good' sightings was more or less evenly distributed, with concentrations of sightings in the west from 145° 10´E to 145° 20´E, and in the east from 147° 50´E to 148° E. There were no seasonal differences in reported sightings (29% summer, 26% winter, 23% autumn, 22% spring). The preponderance of sightings, 95% (298) (n=315), were of a single animal, with 65% occurring during the night (6pm–6am), of which 48% were reported during the hours of 6 pm to midnight. The peak hour for sightings was 8–9 pm. The number of observers present at each sighting varied from 1 to 8, with 56% of this total being single observers. In terms of mobility, 55% of sightings were made by motorists and 42% by pedestrians, and 54% of sightings lasted less than 10 seconds. Sightings made from motor vehicles were generally brief, whereas sightings made by pedestrians were typically more extended, with 44% claimed to last for >1 minute. All sightings occurred closer than 500 metres, and in 36% of cases, within 10 metres.

Nix (Anon. 1990) developed a method called BIOCLIM (an early presence-only surface-envelope species-distribution model), which used location records combined with spatial environmental data to predict where a species or ecosystem should most likely occur. Intrigued by the frequency of Thylacine sightings, he decided to investigate how closely the sightings correlated with a BIOCLIM-generated map of where Thylacines theoretically should still exist. Nix sourced data on where Thylacines were shot and trapped from the late 1800s to the early 1900s from various scientific collections and government records (Anon. 1990). From these data, he produced a map showing optimal, sub-optimal, and marginal areas of potential habitat. He then compared sighting records from 1936 onwards and classified them into three groups based on their level of reliability. Discounting the unreliable sightings, he used the remaining sightings as independent datasets to compare with the BIOCLIM map. The data sets matched well with where the BIOCLIM model predicted that Thylacines should still exist, with the greatest frequency of sightings clustering within the areas of predicted optimum habitat. Statistically, Nix concluded that the chance that these independent data sets should so closely coincide was virtually zero, leading him to assert that "*these people are really seeing Thylacines*", and advising that a thorough search ought to be made.

Tasmanian Thylacine Sighting Record Database (TTSRD)

A detailed understanding of the factors that led to the rapid decline in the Thylacine population in Tasmania is important for informing conservation and extinction biology and was the primary motivation for the creation of the TTSRD (Brook *et al.* 2023). The aim of this work was to produce an exhaustive, documented compilation that also serves as an ongoing, publicly accessible, and regularly updated resource (submission of new records to the corresponding author is welcomed). To this end, all known Tasmanian sighting records (mainland sightings were excluded from the study) that had some form of documentation have been collated for the period 1910 ('post-bounty') through to the present (currently, the most-recent entries are from 2020). These records were sourced from Sleightholme & Campbell (2016), Tasmanian Archives & Heritage Office, Queen Victoria Museum & Art Gallery, Tasmanian PWS, Moeller archives, Animals & Birds Protection Board, Guiler correspondence, Bailey files (private), Laird files, International Thylacine Specimen Database (6th revision), Paddle (2000, 2012), Gordon files (private), the Thylacine Museum website[8] as well as various online platforms. The resultant database is a substantial advance on previous efforts, with four times more sighting records than either the Smith or Nix studies and extended by up to four decades, with rigorous quality control (to find and remove or merge duplicates) and geo-referencing.

The database is publicly available for download from *GitHub*: https://github.com/BWBrook/ttsrd

8 http://www.naturalworlds.org/Thylacine/

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This includes R code for analysis (see extinction modelling in Brook *et al.* 2023), the database in Microsoft Excel and CSV (flat-file) formats, spatial data layers, and all original sighting documentation provided as image files (scanned or photographed).

Structure and format of the database fields

A total of 1,223 records were sourced, and their details entered into the TTSRD in a standardised format. Each record was assigned a unique ID number and the month (or season), year and primary and secondary locations were noted. Additional meta-data included the geographical accuracy of the sighting, observer mobility, time period (day / night), number of observers, number of animals, and the distance from the subject(s) graded on either a three or four-point scale. A record was made of the source reference, the observer reporting the sighting, and any noteworthy remarks pertaining to the sighting. Confidentiality requirements necessitated the redaction of some elements of the source data (e.g., names and addresses) for 89 records, but every effort was made to prevent this impacting on the content of the reports required for analysis.

Note that in a recent modelling exercise (Brook *et al.* 2023) the data analysed included 1,237 records (version 1.0). However, recent information revealed that 12 of these records had resulted from errors in earlier analyses of Beaumaris Zoo records, and two others were identified as duplicate reports of the same animal. These amendments have been noted in the Reference tab of the TTSRD, version 1.1.

Each sighting was reviewed critically and assigned a type graded on a 10-point scale, from the highest quality, K (kill with confirmed body) to the lowest quality, O*I (report of animal sign [e.g., vocalisations or tracks] that were considered doubtful) [Table 1a]. Each sighting was then quality rated on a 5-point scale from 1 (unlikely or low quality), to 5 (likely/credible) [Table 1b]. Consequently, all the sighting records carry an alpha-numeric type quality/credibility rating identifier. These classifications were also grouped into the broader categories of physical records (PR, n = 86), expert observations (EO = 337), expert indices (EI = 91), other observations (OO = 601) and other indices (OI = 108). The source record was scanned, and a digital version assigned a unique attachment number. Finally, the database was thoroughly checked for duplicate and erroneous entries, and any found were archived and removed.

An analysis of the attributes of each sighting is summarised in Table 2. The geographical accuracy of sightings was graded from precise, where the exact map coordinates or detailed description of the sighting

Table 1. A) Top: Ten-point type quality scale used to grade sightings. Note that the O* class (the most commonly assigned in the database, especially for post-1950 observations) includes many lower-quality records (e.g., likely confusion with dog, quoll etc., fleeting glimpse, less-reliable witness, Thylacine sign that is medium-to-low quality, etc.) B) Bottom: Five-point credibility quality scale used to grade sightings. These are based on a synthesis of the observer type, observation details provided, date and locality, and other information contained in the original record (provided as photographed attachments). Much of this categorisation is inevitably subjective: we based it on the clarity and detail within the recounting and in some cases on the background and experience of the observer.

A

Type	Description (S to O*I are subjective)
K	Kill, with body/skin/photograph produced
K*	Claimed kill, no definite body/skin produced
C	Live capture, confirmed
C*	Claimed capture, no live animal produced/ confirmed
S	Sighting by experienced observer from 1910s-1940s era (bushman, ranger, wildlife expert, etc.)
SI	Tracks, cats, lair etc. identified prior to 1940 or later by experienced bushman or wildlife expert
O	Observation from non-expert (e.g., public layperson), but still of medium-to-high quality
OI	Tracks, scats, lair etc. identified by non-expert, especially after 1960s, plus all vocalisations
O*	Second-hand and vague accounts (e.g., unclear recounting, few details given, fleeting glimpse, etc.)
O*I	As for O* but for reports of secondary evidence, e.g., tracks, spoor, lair etc.

B

Grade	Description (subjective)
5	Likely/credible
4	Plausible
3	Inconclusive
2	Implausible
1	Unlikely or low quality

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Table 2. Analysis of the attributes of Thylacine sightings from 1910 to 2019, comprising geographical accuracy, sighting location, observer mobility, time period, number of observers, number of Thylacines seen, and the distance from the observer to the subject animal. See text for findings.

Geog. Acc.	#	Sight Loc.	#	Obs. Mob.	#	Time Per.	#	No. Obs.	#	No. Thyl.	#	Distance	#
Precise	27	Bush	765	Walking	773	Day	533	1	766	1	1043	Near	825
Approx	1149	Road	376	Driving	364	Night	348	2	269	2	99	Far	148
Broad	38	.	.	.	.	.	.	3+	130	3+	77	.	.
Unkn	9	Unkn	82	Unkn	86	Unkn	342	Unkn	58	Unkn	4	Unkn	250

location were known, to approximate, centred on our best estimation of the general location of the sighting, to broad subregion, e.g., 'west coast', and finally, unknown. Sighting locations were classified within three groups: for those reported on a road, path, or track, those reported in the bush (forest, paddock, plain, off-track), and those sightings for which the location was unknown. Five sightings could not be placed within these categories; 3 being beach sightings, and 2 reported from within a dwelling, but were included in Table 2 with unknowns. The number of sightings reported from observers in native vegetation or away from roads and tracks gradually diminish with time from 1910 to the present day, with a corresponding increase in sightings observed from roads, tracks and beaches. This finding is closely correlated with sightings from observers on foot and those in motorised vehicles. These findings might be attributed to the increasing use of private cars after 1950, the opening up of the interior of the State with new roads, and the subsequent increase in intra-state tourism that accompanied these developments.

The time of day that sightings were reported was classified into three groups: those made at night (including dusk / dawn with partially obscured visibility), day (under good illumination), and those that were not specified. One sighting included with unknown was reported both day and night. The high percentage of daytime sightings noted by both Sleightholme and Campbell (2018) and particularly this study, indicate the regular occurrence of this behaviour. Gunn (1838) states: "*They are usually nocturnal in their attacks on sheep, but they also move about in the daytime*" (such attacks were often misattributed, however). Guiler & Godard (1998) concur: "*It is generally agreed that Tasmanian tigers are nocturnally active, despite 47% of all sightings being recorded in daylight hours. Most of the species upon which the Thylacine feeds become active in the bush in the early evening… and some are still to be seen lazing in the sun… well after sunrise. There is no reason to assume that the tigers would not be active at these times*". Paddle (2000) agrees: "*Significant diurnal hunting behaviours are to be expected*" and continues: "*The majority of late nineteenth- century and early twentieth- century observations of diurnal behaviour relate to hunting usually taking place in the morning or late afternoon*".

Observer mobility was categorized within three groups: sightings made whilst driving (4WD, car, motorcycle, bus, etc. or horse riding), those made whilst walking, and sightings where the observer mobility was unknown. The number of observers present when the sighting was made was categorized within four groups: sightings made by a single individual, those made by a pair of observers, sightings made by multiple observers (3 or more), and those where the number of observers was not specified, noted or applicable. The distance from the observer to the subject animal was graded under three categories: sightings made within 30 yards or metres distance, sightings made at more than 30 yards or metres, and those where the distance was not specified. Most observations were of a solitary animal (Table 2), but 24 reports noted multiple sightings without specifying number, with three reports making no reference to number.

In summary, on the basis of the patterns in these data (Table 2) the most-typical record is of a *close sighting of a single Thylacine by a solitary observer made while walking in the bush during the day* (18% of records, but with a high variance in the specific circumstances).

Analysis and discussion

The last fully documented kill of a Thylacine was made by Wilfred Batty at his father's farm at Mawbanna on 13th May 1930 (*Advocate*, 14th May 1930, p.6), see TTSRD [#109] (hereafter all TTSRD records will be referred to with [#ID]). The last confirmed capture (where the live animal was produced) was made by James Kaine at Preolenna in the north-west in March / April 1931 (Sleightholme *et al.* 2020) [#127]. However, based on an interview by Guiler, a bushman (Tepper) reported to have caught a female Thylacine and three pups in October 1935 at Dempster Plains [#149], and had started to negotiate their sale to the Hobart Zoo when he claimed that his dog got into their pen and killed them all. In 1937, in the Jubilee Range in the south-west, Joseph Farrow (a bushman familiar with the species) caught

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a Thylacine in a snare that subsequently broke [#185]. Farrow had previously caught a live Thylacine for sale to the Hobart Zoo, and so was familiar with the species. Trooper Boyd's police report of this incident in August 1937 expressed no doubts about the veracity of the report. Boyd was subsequently asked to accompany Sharland on the November 1938 expedition, indicating a familiarity with the Thylacine and the early trappers.

The totals for each of the sighting quality types listed in Table 1 were divided on the basis of five different time periods, with date-spans chosen to best reflect the Thylacine's recent sighting history [Table 3]. The five time periods are of variable duration, ranging from 16 to 35 years.

i. Post-bounty period through to Batty kill (1910–1930): 21 years;

ii. Pre- and post-war expeditions (1931–1946): 16 years;

iii. Guiler early period (1947–1966): 20 years;

iv. Concerted push for re-discovery (1967–1984), Griffith, Malley and Brown, Smith and Pyrke, Mooney, Wright: 18 years;

v. Contemporary evidence and new technology (1985–2019): 35 years.

Figure 2 shows Thylacine kills (with the body produced [K] and without [K*]) and captures (with a live animal or other confirmation such as a body, skin, or photograph [C] and without [C*]) for the five designated time periods. As can be seen, the number of confirmed kills and captures diminishes substantially from its peak in 1910-1930. We note that the species was legally protected from the 10th July 1936 onwards, with the risk of fines or possible imprisonment. That said, post-1936 illicit kills (and accidental captures in snares) probably did occur after this date but went unreported for fear of prosecution (Brook *et al.* 2018).

Many of the unlawful post-1936 purported kills have only come to light in recent years, often after the individual(s) responsible had died. Griffith (1972a) states: "*It is common knowledge in Tasmania that there were others killed after this date* [1936]". Bailey (2019) concurs: "*It was well known in rural communities that Thylacines were killed illegally after 1936, either accidentally whilst trapping for game, or with deliberate intent*", and qualifies his statement by citing Guiler's 1953 interview with the bushman Herb Pearce (Guiler 1985, p.116). Pearce recalled that in 1947 his dogs flushed a female Thylacine and her three pups out of a patch of man ferns (*Dicksonia antarctica*) in an area now flooded by Lake King William [#259]. Guiler & Godard (1998) state "*Pearce said he turned his dogs on them, but continually dodged the issue as to whether the tigers were killed or not. It is likely that*

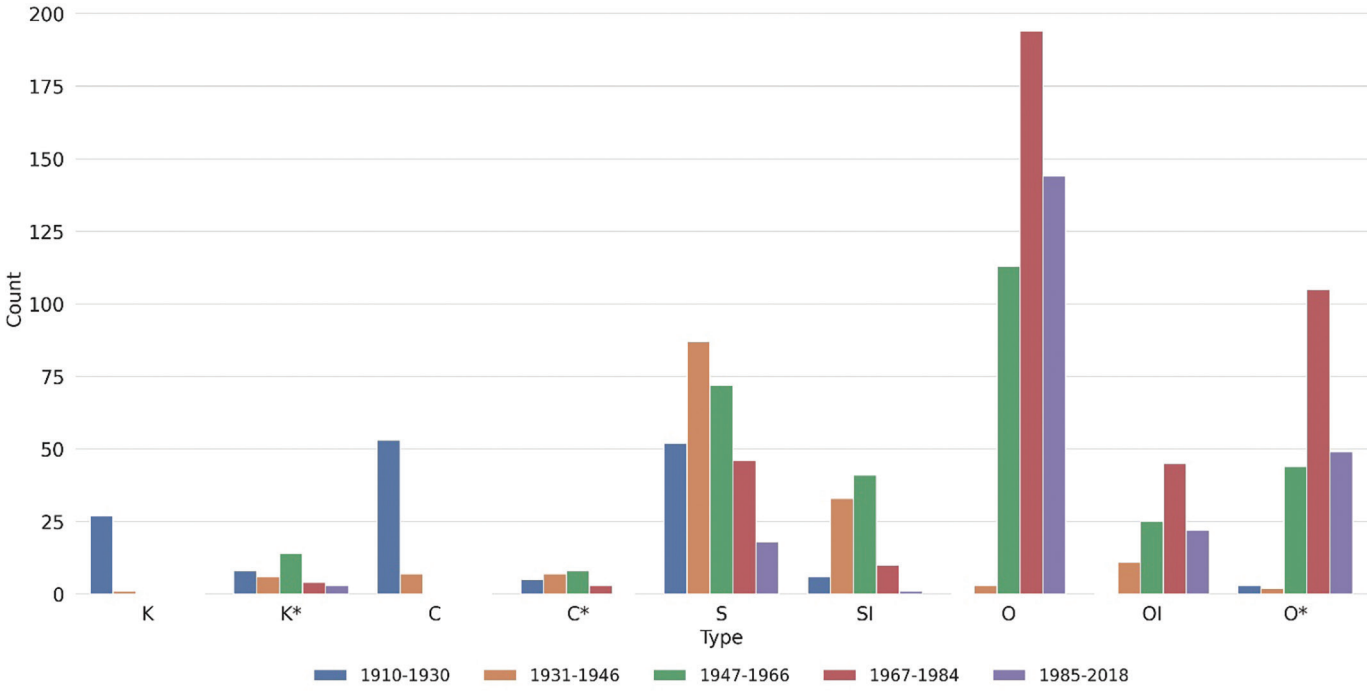

Figure 2. Number of reports of Thylacines, categorised by type of record, over five time periods: 1910–1930, 1931–1946, 1947–1966, 1967–1984 and 1985–2018. K: kill with evidence, K*: unconfirmed kill with no evidence, C: confirmed live capture, C*: unconfirmed capture, S: sighting by expert, SI: tracks, spoor, lair prior to 1940 or later by experts, O: non-expert sighting, O*: second-hand and vague accounts, OI: Tracks, spoor, lair and vocalisations by non-experts after 1960 (see Table 1a for further detail on the sighting type). We have not recorded the O*I categories in this figure.

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they were, and he knew that it was wrong to kill them". Graves (1958) reports on two hunters who caught a Thylacine in a possum trap and killed it. This incident occurred near the town of Mathinna in the north-east in 1952 [#471]. Terry (2005) details a 1954 account of a retired cattle driver from Pioneer in the north-east who found the rotting corpse of a Thylacine in a snare [#622]. Maynard & Gordon (2014) provide details of a reported Thylacine kill received by the Queen Victoria Museum in 1999. The report [#268] related to a kill in Natone in the north-west in 1949: "*My father was a bushman. One night he arrived home, he was both upset and excited. He put his sugar bag down on the floor and pulled a dead animal from it. It was still warm. He said 'I have never seen anything like this before'. He then went on to say that he was on his way home from work, the animal had attacked him and no matter how hard he tried to get away from it, it just would not let him get away, so he was forced to kill it with a piece of wood to save his life. This upset him very much, as he did not like to kill animals unless it was food. However, his excitement grew as we looked and touched this strange animal. It had sloped hindquarters. Although it looked like a dog-type animal it had differences. Its jaw was long and instead of round it looked a little squarer; across its body it had stripes. My father had brought home a Tasmanian tiger. It evidently had pups although he searched for two days he could not find them. Its mate could have taken them and hidden them. The Tasmanian tiger was buried in our garden and the year was 1949*". Gordon (pers. comm., 24th May 2017), who investigated the report, states: "*She* [bushman's daughter] *was very genuine and I didn't doubt her story*". In June 1962, a report was received by the NPWS of a Thylacine that had been sighted late one afternoon near Mawbanna in the north-west and a shot had been fired. Although no trace of a body was found following the incident, the description given of the animal was deemed by NPWS authorities to be excellent [#1166].

All pre-1936 captures [C] listed within the TTSRD (n = 48) are well documented, and with few exceptions, were destined for zoo display. There are 16 live captures listed within the database as occurring post-1936, but with no specimen confirmed [C*]. Griffith (1972a) notes in his diary that in 1971, near to the Kerry Lodge Bridge in the north, five young men caught a Thylacine in a rabbit trap. After freeing it, they held it up and accurately noted that its penis protruded backwards. This anatomical peculiarity would have been unknown to them and consequently, adds substance to the sighting. The men reported that when they placed the Thylacine onto the ground it escaped and limped off into the bush [#800]. Bailey (2016) details an interview with the bushman Tom Billett in which he recalled snaring a Thylacine at his property in Smithton in the north-west in the early 1950s that, despite his best efforts to secure it, escaped from the snare [#282]. He recalled: "*The tiger became tangled up in the wire until it suddenly snapped the snare rope and scared the hell out of me as it bolted off into the scrub*". In the Appendix to *Concerning the Thylacine* (Griffith & Malley 1972, unpublished report), Stingle recalled seeing a Thylacine caught and released by Harry Jenner in the Fingal-Avoca area in the north-east in 1947, and then hearing the calls of two Thylacines in the same area three days later [#889]. A 1972 report in the PWS Thylacine files details an interview with the bushman Percy LeFevre of Winneleah, in which he recalled capturing a Thylacine in a snare under the north side of the Blue Tier in the north-east in 1953 [#288]. He remembered it breaking loose from the snare as he cautiously approached. The bushman Roy Bliset had snares in the Dip River area in the north-west and reportedly caught a Thylacine in 1943, but nothing remained next morning (no further details) [#785]. Reports of this type from the decades immediately following the 1930s, made by respected bushman who knew the Thylacine well, are difficult to discount.

Sightings from experienced observers [S], represented by the bushmen that trapped the Thylacine, together with NPWS Rangers and wildlife experts, are shown in Figure 2. After the kill [K, K*] and capture [C, C*] records, the "S" reports are important, as these observers, being familiar with the animal, would have been less likely to have made an error in identification. From a peak in 1931–1946, these high-quality sightings continue to the present day but in declining numbers. An apparent explanation for the observed decline is that few of the early bushmen and trappers from the 1930s and 1940s are still alive, so the reduction in sighting reports from those with direct familiarity with the animal, from the 1950s onwards (Figure 2), is an inevitable consequence of their passing. This also applies to the SI reports, as only experienced bushmen would be readily able to correctly identify tracks, scats or a lair based on past experience from when the species was still present in its habitat. The dearth of S and SI observations in 1910–1930 period (Fig. 2) could be due to the fact that such sightings would have been considered unremarkable and not worth reporting during that time. Nevertheless, post the 1960s the PWS Thylacine files detail numerous sightings that were assessed at the time of their reporting to be "excellent". For example, in February 1963, a shooting party of three experienced hunters reported sighting a Thylacine near to Greens Creek in the north-east at approximately 50 yards (46 metres). It moved slowly and turned side on to them, giving them a clear sighting and enabling a positive identification [#1176].

In 1972, three older bushmen who knew the species well, purportedly observed a Thylacine for 40 seconds

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at Mawbanna in the north-west [#1241]. In the summer of 1962, a NPWS Ranger accompanied by another person described their apparent sighting of a Thylacine walking along a creek at Evandale in the north in pursuit of a rabbit [#1130]. In 1969, an older couple who had previously seen Thylacines at the Melbourne Zoo, said that they sighted a Thylacine at Derwent Bridge in the central highlands crossing the road in front of their car. They were able to give the investigating officer an extremely detailed description [#1173]. In one account from 1989, a group of forestry workers were cutting timber on a concession in the Florentine Valley in the south-west. They were about to commence work when they claim to have encountered a Thylacine which appeared to be lame in the back legs. The workers refused to start work and gave the Thylacine a bowl of water. Their foreman ordered them to vacate the area until the next day in order to give the Thylacine time to recover and move on. The following morning, they could not find the Thylacine, but they did locate remains of an animal killed and eaten by Tasmanian Devils during the night, which they believed to be the Thylacine. This incident, with multiple observers, was not well-reported at the time and is still not widely known [#515].

The most widely publicised Thylacine sighting was that made by NPWS officer Hans Naarding south of Togari in the north-west of Tasmania in 1982 (illustrated in Fig. 1 and detailed in the Box) [#401]. A sighting of equal standing to that of Naarding was made by the veteran Thylacine researcher Col Bailey (now deceased) in the remote Weld Valley in the south-west in March 1995 [#417]. Bailey was on a routine field trip to the valley and reported observing a Thylacine at close quarters for several seconds before it disappeared into the bush. Bailey interviewed many of the old bushmen who trapped Thylacines, giving him a unique insight and detailed knowledge of the species. Archer (2013), who is sceptical of the Thylacine's survival, states: "*When I know the man, like I know Col, that's not just a normal sighting.... that's coming from a really credible person whose judgement I would never question*". Another highly rated sighting was that reported by Ken Clark in the far northeast corner of Surrey Hills in the north-west in 1997 [#1294]. Clark was a security guard out on a routine night patrol when he claimed to witness a steady stream of animals (Tasmanian Pademelon *Thylogale billiardierii*, Bennett's (Red-necked) Wallaby *Macropus rufogriseus* and Common Wombat) cross the road in front of his car. He braked hard, looking to see where they went. Returning his gaze to the road, he saw a Thylacine standing on the road some three metres in front of his car, surrounded by dust. He first thought the animal was a wild dog and intended shooting it if it was, but as soon as the dust settled, he realised it was not. He described the animal as "*being similar to the general build of an Alsatian dog, but with a very large head and a medium length, short haired tail held almost horizontally. The hair was short and dark brown with clear chocolate-coloured stripes*". He was struck by the lack of a dog-like, rounded rump – "*instead it sloped back and under*". He observed the animal for around 1 minute before it left "*turning awkwardly as if there was no articulation in the spine*". In the official NPWS report on the sighting, wildlife biologist Nick Mooney states: "*He is familiar with local wildlife and not prone to exaggeration. I have little doubt that he believes he saw a Thylacine. If he did it was an adult (i.e., probably resident) and likely a male (at this time of year I would expect an adult female to be suckling denned young and therefore have a loose pouch area). In all respects, this sighting is as good, if not better, than that of Hans Naarding in 1982. The geographical area has produced most of Tasmania's best reports in the past decade*".

The "I" series of reports encompasses tracks, plus all other Thylacine signs (e.g., dens, scats) and vocalisations, identified by bushmen and wildlife experts [SI] or non-experts [OI]. Finally, the "O" type are direct observations that are apparently plausible but come from non-experts and second-hand accounts. Records that contained few details or the description could apply to a different species: i.e., a dog[9], Tasmanian Devil, cat or quoll *Dasyurus* sp. etc., and where the recounting was unclear or described a fleeting glimpse were assigned as [O*]. Thylacine signs of medium to low quality were given [O*I]. As can be seen from the Figure 2, the three "O" series graphs resemble each other in configuration, all with peaks between 1967–1984. This occurrence is possibly explained by the increased interest generated by the publicity given to various searches throughout the period. The greatest number of "O" graded sightings are those reported by motorists that sight Thylacines on country roads, usually at night. Although a number (perhaps most) of these reports appear to be misidentifications, some seem harder to dismiss, particularly when witnessed by more than one individual.

The question is apparent that if Thylacines are being misidentified, is a State-wide pareidolia effect occurring, in which observers unconsciously attribute a recognisable form (Thylacine) to a fleeting glimpse of an unknown but superficially similar form (devil, macropod, quoll, cat, dog, or deer)? A study by Paxton & Naish (2019) suggested that reports of the Loch Ness monster were directly influenced by the discovery of dinosaur fossils in the early part of the 19th century. These researchers examined over 1500 sightings from 1801 to the 1930s and concluded that fossils of

9 It is notable, that feral dogs are not known outside areas of human settlement in Tasmania, and none of the field camera studies, Guiler (1961; 1963-1964; 1980-1981), Smith (1978-1980) and Mooney (1982-1983), have ever recorded them (although these were surveys with old-tech cameras prone to malfunction and placed at low density).

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Box: Notable post-1936 Thylacine sightings in Tasmania

Since the death of the last captive Thylacine at the Hobart Zoo in 1936, there have been hundreds of unconfirmed sightings. Many can be discounted as simple misidentifications, but some are harder to dismiss. Below is a selection of some of the more convincing sightings:

Police Officer Billing's two separate sightings of a Thylacine near Waratah (northwest Tasmania) in 1942, one at a distance of 6 metres and the other at ~50 metres. Billing completed an extensive report on the sightings for his superintendent. [#206 TTSRD]

In 1952, Dr Eric Guiler interviewed the legendary bushman Herb Pearce, whose family submitted many claims during the bounty years. Pearce recalled an incident in 1947, in an area now submerged by Lake King William, where he set his dogs onto a female Thylacine and her three pups. Guiler believed Pearce's claim to be a true account and that all these Thylacines were killed. [#259 TTRSD]

In February 1959, Les Barnard sighted a juvenile Thylacine in the lights of his car on a forestry road near the Arthur River. He observed the animal for several minutes and noted its stripes. The incident was reported at the time to the Queen Victoria Museum in Launceston. [#702 TTSRD]

In 1972, a crew of forestry workers working near Trowutta observed a Thylacine at 150 yards walking down the track towards them. The Thylacine approached to within 100 yards before dashing off into the scrub. [#865 TTSRD]

In 1981, John Yates and three fishing colleagues observed a Thylacine walking along a west coast beach. Yates owned a Thylacine skin snared by his wife's grandfather, so he was familiar with the species. As the group of fishermen all reported the same sighting, mistaken identity is improbable. [#395 TTSRD]

Perhaps the most important sighting to date is the much-publicised sighting of Hans Naarding south of Togari in March 1982. Naarding, a PWS officer, observed a Thylacine from his vehicle, using a spotlight, for several minutes. His account was detailed and convincing, and the way it was investigated during the subsequent two years leaves no doubt that the TPWS was convinced at this time that the Thylacine still existed. The redacted PWS report (Mooney 1984) on the investigation states: "*It was concluded that the search area was used at least irregularly by Thylacines until Autumn 1982 but use diminished due to increased disturbance to the point that detection of animals is not probable, despite large efforts. Unless the Thylacine observed in March 1982 by the Service biologist was the last of the species, it must be accepted that Thylacines survive in a number of areas in Tasmania*". [#401 TTSRD]

Peter Carter, an old-time prospector and game trapper who knew the Thylacine well, claims to have seen a tiger in 1983 near the area where Naarding made his sighting. The sighting was at night, and he followed the animal in his spotlight for around 3 minutes. [#867 TTSRD]

In 1986, an elder bushman Turk Porteus who was familiar with Thylacines from the early part of the century, sighted a female Thylacine near the Frankland River. Porteus records that he observed the Thylacine for several minutes before she shot off into the bush. [#406 TTSRD]

In 1989, a group of forestry workers (Barratt, Burns, Henderson & others) employed by the Australian Newsprint Mills on the Florentine Valley concession were about to commence work preparing an area for logging when they came across a lame Thylacine. The gang refused to start work and, giving the Thylacine a bowl of water, waited for the gang foreman who ordered them to vacate the area until the next day in order to give the tiger time to recover and move on. The following day, they did not find the tiger, but did locate the remains of an animal killed and eaten by devils during the night. They believed the remains to be those of the tiger. All of the men came from long-time resident forestry families and knew the Thylacine well [#515 TTSRD].

Another significant sighting is that of respected author and Thylacine researcher Col Bailey at the Snake River in March 1995. Bailey researched Thylacine sightings for nearly 40 years and knew the animal and its habits well, so an error in identification is highly improbable. Bailey encountered a Thylacine on a field trip and observed the animal at close quarters for several minutes. [#417 TTSRD]

In May 2002, an environmental scientist working in the southwest of the state observed an adult and juvenile Thylacine in the same location, a day apart. The scientist was familiar with Tasmania's wildlife, having worked in the bush for five years, so an error in identification is improbable. [#422 TTSRD]

High-quality sighting reports such as these highlight the necessity to properly assess the reliability of sightings data in any assessment of extinction.

long-necked marine reptiles appeared to influence what observers reported they saw in the loch. Comparative parallels can be drawn with Thylacine sightings and their relation to media reports.

In terms of the spatial information included in the sighting record, Smith (1981, Fig. 3(i)) produced a total sightings map for the period 1936-1980 (n = 315). The most obvious similarity between the Smith map and an expanded map produced from the TTSRD data [Fig. 3 (ii)] are the density and clustering of sightings in the far north-east of the State. In an attempt to provide a more reliable map of Thylacine distribution from 1910 to 2019 than the Smith and the TTSRD maps indicate [Fig. 3], only the most credible sightings have been retained. If all of the lower grade "O" series sightings are removed, leaving only the "K", "C" and "S" series (Fig. 3, n = 535), the pattern revealed is different. For 1910–1930 (Fig. 4 (ii), n = 169) and 1931–1946 (Fig. 4 (iii), n =144) there are clusters of sightings located in the western half of the State, and an indication of post-1936 survival in and around the Ben Lomond NP in the far north-east. From 1947–1966 (Fig. 4 (iv), n = 137), populations in the west, although diminished, appear to have remained extant. After 1966, the TTSRD records are characterised by a general reduction in the number of sightings across the State.

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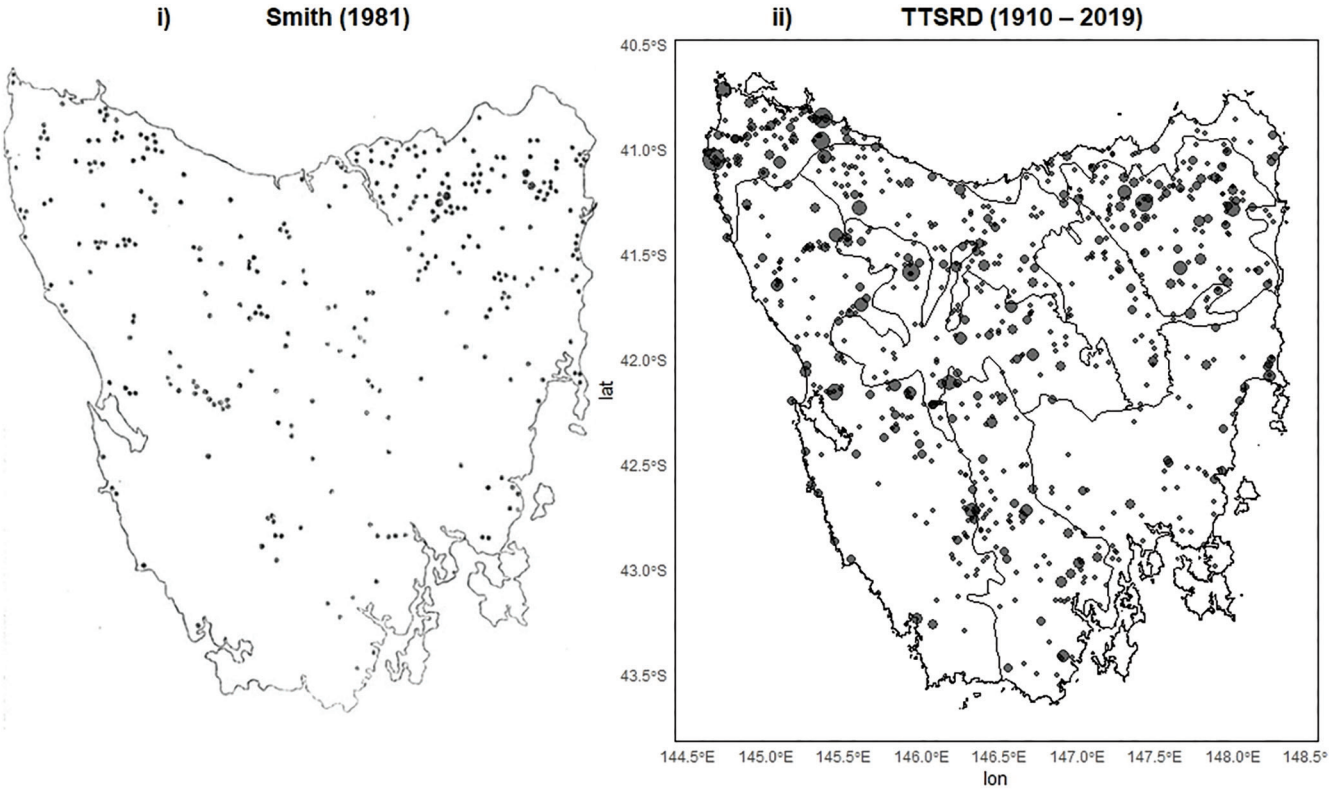

Figure 3. A comparison between i) Smith (1981) sighting map totals [*n* = 315] for 1936–1980 and ii) TTSRD map totals [*n* = 1223] for 1910–2019. The size of the circles in map ii) represents the number of independent Thylacine sightings reported from that location. Internal lines show the borders of the Tasmanian Interim Biogeographic Regionalisation of Australia (IBRA), provided to show a spatial visualisation of the varied ecoregions that exist across the island of Tasmania.

Connected sightings?

In an effort to interpret the spatial patterns of thylacine sighting records in the Fig. 4 maps, an examination of a number of clustered sightings was undertaken. Clustered sightings are those reports made by two or more independent observers of the same animal (or animals) within a specific time span and within the same general geographical locality. Here, we focus on the northwest of Tasmania, an area with a high concentration of sightings within 100-200 km that occurred within a 2-year period. The long-term wandering patterns of individual Thylacine are unknown; however, large cursorial predators typically range widely, and the Tasmanian Devil can move 10 to 15 km in a single night of foraging. Collectively when the sighting attributes are assessed, clustered reports acquire added importance as the probability of them being contrived or the animal misidentified is low, especially if independently reported.

In May 2002, a couple were travelling along a road in the far northwest of Tasmania and reported sighting a Thylacine sniffing the road for 30 seconds at 250 metres [#1273, graded O5]. This was a day-time sighting. In their report to the PWS they state: "*Sniffing the road and wandering on the road. Its movement was very different with front feet moving together and back feet together – a bounding motion. Extremely distinct tail, straight out and no significant rump/backside. Very dark brown, but did not see any stripes on it at all. Approximately 600 mm high at the middle of the back. Most of the time facing the vehicle, not side on. If any stripes, they were not visible. Gone quickly when aware of the vehicle with very big leaps. Definitely not a devil or either of the quolls – too big*". One month later, along the same stretch of road, an environmental scientist with detailed knowledge of the species, described seeing a juvenile Thylacine [#422, graded S5]: "*The animal was walking slowly along the track facing me, and I could see that it was quite slender, but still about the height of a medium sized dog. The colour appeared chocolate brown with golden tinges on hair around the edges of the body. The sun had broken through and was shining in the animal's face. Its head was down casually sniffing the ground, and it took a second or so to realise I was approaching... As I approached at high speed the animal looked up suddenly, then turned, and ran to the side of the track. I clearly saw an unmistakable Thylacine shape and loping running style. As it reached the track verge the animal bounded about 3m across a gutter cutting. While it was stretched out in mid-air several images were burned in my mind; the sharp back hocks and tail continuous with the body, the large head and round paw-like front feet, the deep chest. The body hair was short and smooth. The animal*

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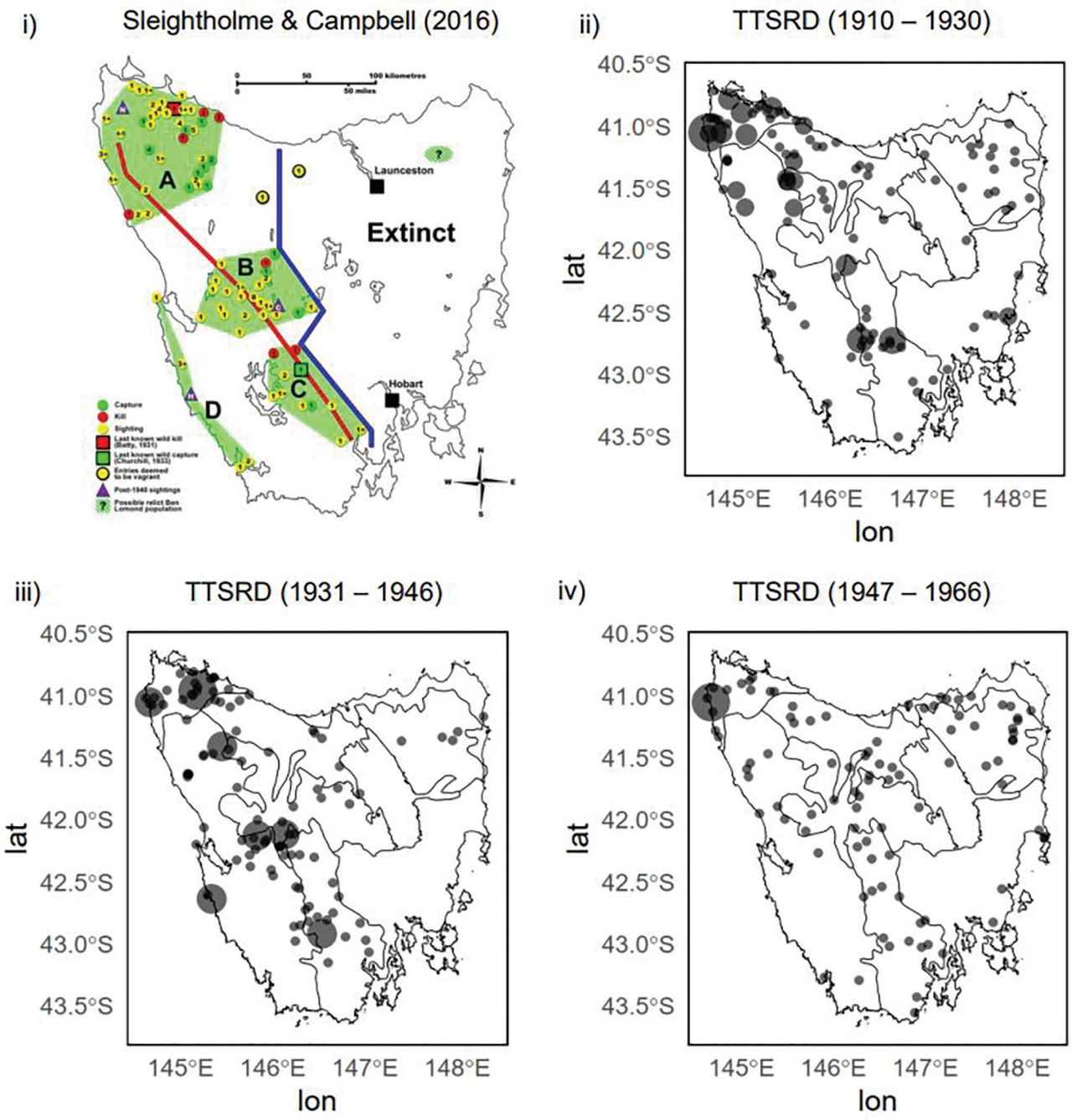

Figure 4. Sightings maps comparing i) Sleightholme & Campbell (2016, ***n***=127) for the period 1930–39 with the TTSRD for the periods ii) 1910–1930 [***n*** = 150], iii) 1931–1946 [***n*** = 110] and iv) 1947–1966 [***n*** = 95], based on the highest quality records of K-, C- and S-type. The size of the circles in maps ii) to iv) indicates the number of independent Thylacine sightings reported from that location (largest circle represents >10 observations), and the internal lines show the borders of the Tasmanian Interim Biogeographic Regionalisation of Australia (IBRA), showing the spatial configuration of the island's ecoregions.

used its tail as a rudder while in mid-air... Returning to the car I immediately made a drawing of the animal, and a copy of that original is shown below. I could not see the stripes, but I tell you I did not need to. Tigers in high rainfall areas are said to be darker (Paddle, 2000, p.45), and while it was running I would not have expected to see the stripes anyway. The closest I got to this animal was about 20m, and the total sighting lasted around six seconds. It was definitely a juvenile Thylacine about 18 inches tall". The following day, he reported seeing an adult Thylacine on the same section of road: "*At 4:30* [the next] *afternoon (23/5/02) I was back at the same spot, parked on the side of the track with the back of the car open before a long straight section; preparing for a long night vision stake-out with an invisible infra-red spotlight. At about 5pm the light was fading so I spread the chicken and cat food along the track. After that I returned to the car, then walked across the track to wash my hands in the same creek which had created noise to muffle sound of the approaching car the day before. I carried a video camera*

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at all times. After washing my hands, I was walking back across the track to the car with video camera in hand, looked down the track and saw a large animal walking across about 150m away. Instantly I recognised it as an adult Thylacine. This second animal was very large, with shape and size similar to a panther; longer in the body than the juvenile seen the day before. It was walking casually across the track apparently unaware that I was there. Its head was held quite low as though it was tired, but its general walking gait was very stealthy; a creepy, flowing, robotic walking style I have certainly never seen before. The back line appeared to stay the same while the legs moved underneath. This animal was the same colour as the smaller one seen the day before; like the colour of a Tasmanian pademelon, but a more solid, intense, velvety brown. I could not see the stripes, which is not surprising from that distance. Again, I tell you that I did not need to see the stripes. The shape of this animal was absolutely, unmistakably Thylacine, with the longer body of a large adult male. The shape was perfectly silhouetted against the pale road base of the track". The following month, again, along the same stretch of road, an experienced bushman claimed to have observed a Thylacine chasing two Common Wombats across the road at 5 metres for more than 10 seconds [#973, graded O5]. On returning home, he reported his sighting to the Thylacine researcher James Malley, who rated the sighting highly. We therefore have four Thylacines reported by three independent observers (one couple) along the same section of road within a two-month time span. All observers reported that the Thylacine they saw was of a darker form, which is not the morph typically seen in illustrations (Sleightholme & Campbell 2018) or in any surviving museum specimens, but they do accurately describe the Thylacine's bounding gait and distinctive morphological features e.g., straight tail. Clustered reports like these are difficult to discount, as it is less likely that all observers could made the same error in identification.

Also, in the north-west, near the previously described Clarke sighting [#1294, assigned O5] (Fig. 5), there were seven other sightings reported within 100km between 1995–1997. One sighting was assigned S5 [#849], and the remaining six were assigned O5 [#937, #1300]; O4 [#766, #1316]; O2 [#1311]; and O1 [#848] respectively. It is also interesting that the PWS rated two of these sightings [#1294 and #937] as "*the most promising sightings in 10 to 20 years*".

All of the sightings are located in areas of optimum Thylacine habitat as defined by Nix (Anon. 1990). By observing the month, it is possible to show a plausible movement pattern of a lone Thylacine moving from the south to the north of the state (and its return) over a two-year period [Fig. 5]. These non-random, clustered "S" and "O" sightings therefore seem to collectively support Thylacine presence in the area.

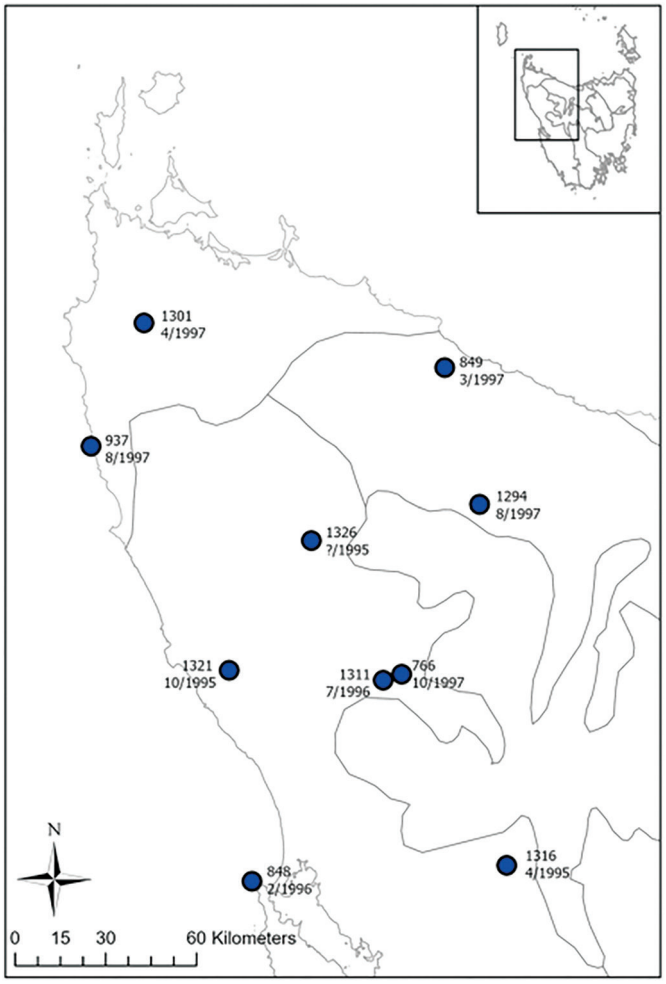

Figure 5. Map of collected sightings from northwest Tasmania, from 1995 to 1997, with TTSRD identification numbers and observation date indicated. Many such spatio-temporal clusters of sightings exist in the TTSRD, but it remains a matter of conjecture as to whether these represent the movements of one (or more) individual Thylacine(s), or simply the chance aggregation of multiple false sightings.

A plausible explanation (contrary to the "null" expectation that all eight were misidentifications) is that the observers did indeed see a Thylacine, and that in all probability, the species persisted in the northwest of the state, at low numbers, until the end of the last century.

Conclusion

Using the TTSRD as a basis, our companion paper concluded via a spatio-temporal statistical analysis that accounted for sighting-record uncertainties (Brook *et al.* 2023) that the Thylacine likely persisted for many decades after the last captive animal died in 1936. The statistical summaries and scrutiny of the records presented here lend some credence to this hypothesis. However, the population clearly never made the recovery hoped for by Guiler (1985, p.181). Instead, the evidence collected within the

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TTSRD suggests that the species was in decline from the 1930s, with subsequent clustered sighting reports indicating a fragmented distribution of remnant populations containing a few individuals potentially surviving in the west of the State to the turn of the 21st Century. This is supported by the data presented in Fig. 2 for S-type sightings, with uncertainty modelling done on these data by Brook *et al.* (2023) suggesting extinction most likely occurred between the late 1980s and early 2000s. Whether the species can still be found in Tasmania today remains a matter of conjecture, although quantitative modelling suggests a low statistical probability (Brook *et al.* 2023; Carlson *et al.* 2018). Ultimately, this outstanding question on the fate of the Thylacine is unlikely to be resolved conclusively to everyone's satisfaction, until a comprehensive (i.e., geographically extensive, temporally sustained) survey, based on a widely distributed network of motion/heat-triggered camera traps, is undertaken throughout the last possible habitats in the remote southwest of the island.

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